Ketogenic Diet for Children with Epilepsy: A Practical Meal Plan in a Hospital

Eunjoo Lee*, Hoon-Chul Kang2, Heung Dong Kim2

1Department of Dietetics, Severance Hospital, Yonsei University College of Medicine, Seoul 03722, Korea
2Department of Pediatric Neurology, Pediatric Epilepsy Clinics, Severance Children's Hospital, Epilepsy Research Institute, Yonsei University College of Medicine, Seoul 03722, Korea

A ketogenic diet (KD) is a dietary approach to treat intractable epilepsy. The KD begins with hospitalization and the child and their parents can adapt to the KD for 1-2 weeks. Recently, various type of dietary intervention such as the modified Atkins diet (MAD) and the low glycemic index treatment (LGIT) have been performed. Since 2010, we carried out the KD, MAD, and LGIT for total of 802 patients; 489 patients (61%) for the KD, 147 patients (18.3%) with the MAD, and 166 patients (20.7%) for the LGIT. In this report, application of these dietary practices in Severance Hospital is shared.

Key Words: Intractable epilepsy, Ketogenic diet, Modified Atkins diet, Low glycemic index treatment

Introduction
Medical treatment for epilepsy includes antiepileptic medication, epilepsy surgery and vagal nerve stimulation. But 30% of children remains with uncontrolled seizure. A ketogenic diet (KD) can be an alternative medical treatment for these children. In general, approximately 50-60% of children show 50% or more reduction in seizure, 15% of whom become seizure free after 6 months of diet treatment [1].

The KD can be traced back to the texts of Hippocrates at the 5th century BC. Wilder (1921) reported significant seizure control effect of the KD at first [2]. The KD is composed of high fat, moderate protein and restricted carbohydrate and it results in a state of ketosis. The most frequently used ratios of fat to non-fat (carbohydrate+protein) in the KD diet 4:1 and 3:1. To maintain strong ketosis state, 4:1 ratio is used and 3:1 ratio is used for under 1 year or older children to improve compliance with the KD. In order to maintain the 4:1 ratio of fat and non-fat (carbohydrate + protein), large amount of fat is needed from oils not only from the fat partially contained in a certain food.

The staple food of Asian countries is rice and fat contributes
Diet Treatment for Intractable Epilepsy in Korea

to 20% of total calories in regular rice-oriented diet. But in the KD, fat contributes to 90% of total calories. Incorporating high amount of fat into the diet is the main challenge to proceeding the KD.

Case

KD initiation

A child suffering with epilepsy is usually to initiate the KD. In our hospital, a KD team is composed of a physician, a registered nurse, and a registered dietitian. During the diet, the physician evaluates and manages complications of KD. Right after the physician, the head of the team, decides to start the KD program, the dietitian provides nutritional management to maintain the KD, and the nurse examines child for tolerance toward the KD diet and educate caregivers how to care child with the KD at home. Frequent communications between caregivers and the KD team are necessary to continue the KD program.

Our KD program starts without initial fasting. Total fat contents in a patient’s meal is gradually increased within 3 days. On the first day the meals provide an 1/3 of energy of daily requirement with a desired ratio of major nutrients. On the second day, content of energy in the meals is increased to 2/3 of daily requirement and achieved to full energy requirements on the third day (Figure 1).

Meal plan

Before starting the KD, the dietitian evaluates the nutritional status of the child at the initial day and evaluates his or her ability to take food, activity level and growth pattern such as current height, weight and weight change.

For the meal planning, the dietitian has to decide nutritional requirement of energy and nutrient distribution. In general case, calories for the KD are allowed up to 85~95% of daily requirement. Total 90% of calories are from fat, 6~8% of calories are from protein and remaining calories are from carbohydrate. Protein can be adjusted by child’s current weight.

For general case example, a meal plan for a five-year-old child, with 108 cm, 18 kg, PIBW 99.4%, has an energy goal of 1,200 kcal with 4:1 of fat and non-fat ratio. This goal is achieved by meals composed of 120 g of fat, 18 g of protein and 12 g of carbohydrate per , which makes the ratio of fat (120 g) to nonfat (30 g) is 4:1. Then these amounts from each nutrient is divided by the numbers of meal supply.

Menu design

The carbohydrate-rich foods such as rice, bread, grain and simple sugars are eliminated. One food is selected from each food group which is categorized to either meat, fish, vegetables, milk or fat sources. The amounts of each food are calculated in grams and the content of nutrients are analyzed to achieve a desired ratio based on the individual nutrient requirement. It is not easy for caregivers to calculate the amounts of each food in grams by themselves. For their convenience, the KD team provides them a computer program to calculate accurate amounts of foods and nutrients contents to minimize human errors. After calculation, the proportions of carbohydrate, protein, fat in calories, the desired ratio, and nutrient requirement of a patients are confirmed (Table 1). The meals are provided in accurate amounts by weighing food with digital precision scale.

Fat sources

In order to achieve the ideal ratio, more fat from vegetable

---

Figure 1. Protocol of the ketogenic diet (KD)